

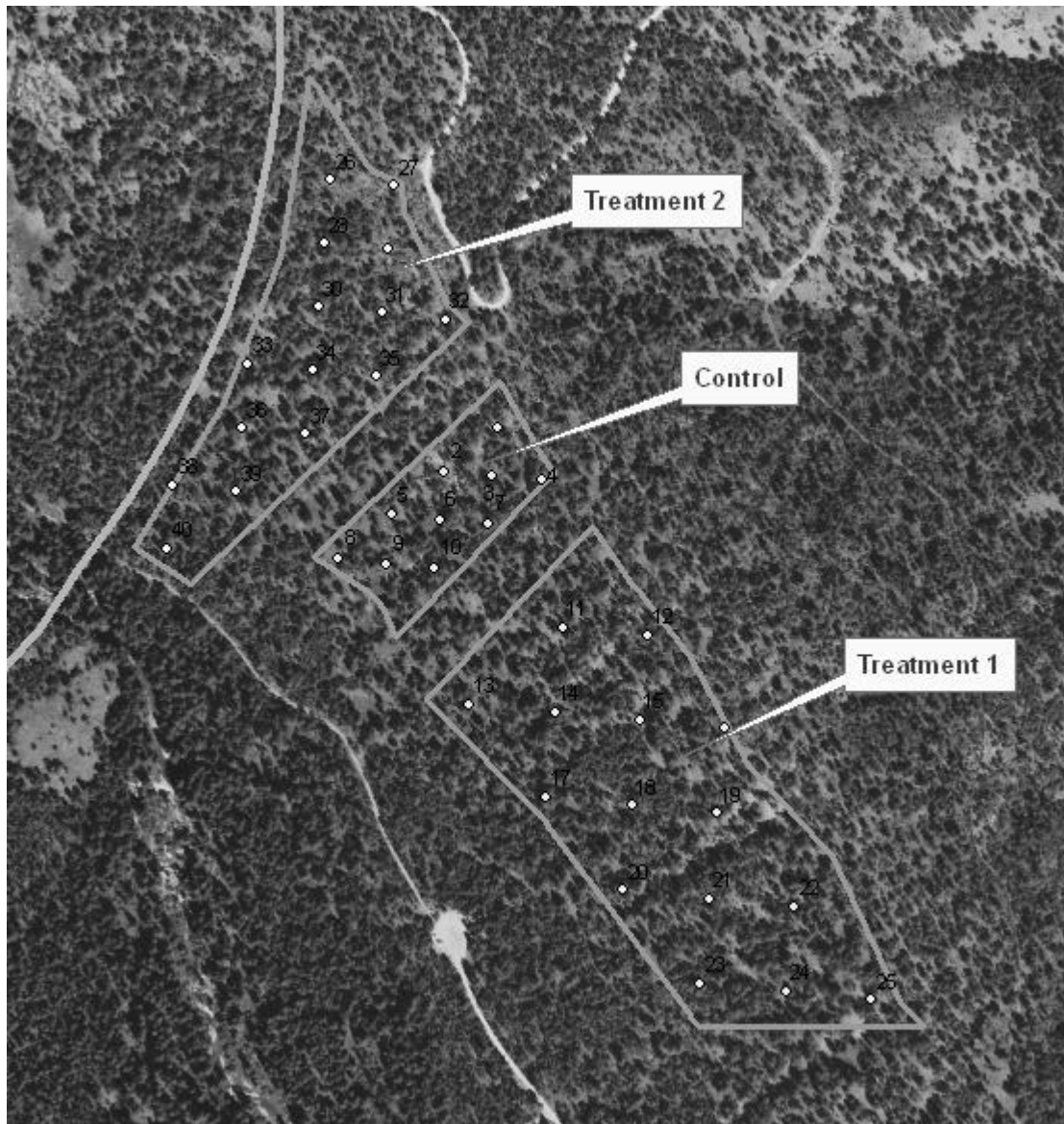
August 3, 2017

R1 Old Growth Monitoring Protocols – Boulder Creek

Contents

R1 Inventory and Monitoring Old Growth Protocols – Boulder Creek.....	3
1. Overview:.....	3
1.A. General Information:.....	4
1.B Background:	4
1.C Number of Plots Installed.....	5
1.B.2 Remeasurement Information	5
1.C. Sample Design.....	5
1.D. Order of Measurement	8
2. Plot Monumentation.....	8
2.A. Plots.....	8
2.B. DWM Transects	8
2. C. Trees	8
4. Plot Establishment:	9
5. Setting Data.....	9
4. Plot Data Form.....	11
CSE 4.15 Plot User Code.....	13
CSE 4.18 Plot History/Remarks (Required)	13
5. Tree Data Form:	14
CSE 5.1 Plot Number (3-digit) <i>Default</i>	18
CSE 5.2 Tag ID Number (4-digit) <i>Default</i>	18
CSE 5.3 Tree Status (1-character) <i>Required</i>	19
CSE 5.5 Growth Sample Tree (1-character) <i>Required for GST trees</i>	20
CSE 5.7 Tree Count (3-digit) <i>Required for seedling groups; defaulted for tally trees</i>	20
CSE 5.9 DBH (3,1-digit; xxx.y) <i>Required for trees > 4.5' tall</i>	21
CSE 5.10 Height (3-digit) <i>Required for all trees, saplings and seedling groups</i>	22
CSE 5.11 Height to Crown (3-digit) <i>Required for all trees</i>	22

CSE 5.12 Radial Growth (2-digit) Required for GST trees with DBH > 3.0 inches	22
CSE 5.14 Height Growth (2,1-digit; xx.y) Required for GST trees < 3.0 inches in diameter	22
CSE 5.15 Tree Age (4-digit) Required for GST trees.....	22
CSE 5.16 Crown Ratio (3-digit) required for live trees including seedling groups.....	23
CSE 5.17 Crown Class (2-character) Required for all live trees including seedling groups.	23
CSE 5.20 Snag Decay Class (1-digit) Required for dead trees	23
CSE 5.22 Tree Damage Category (2-digit) Required for trees ≥ 1.0 -inch DBH/DRC, if applicable.....	23
CSE 5.26 Tree Remarks (30-character)	24
CSE 5.29 Tree Distance (3 digit) Required for all trees all trees (3.0" < DBH)	25
CSE 5.30 Tree Azimuth (3-character) Required for all trees (3.0" < DBH)	25
5. Vegetation Composition	25
Section 7. Down-Woody Materials Form.....	29
7.A. Definition of Down-Woody Materials.....	29
Coarse Woody Debris (CWD).....	29
Fine Woody Debris (FWD).	29
7.B. Locating and Establishing Line Transects	30
CSE 7.2 and 7.3 First Duff and Second Duff (2.1-digit; xx.y) Required	31
CSE 7.2.A and 7.3.A First Litter and Second Litter (2.1-digit; xx.y).....	32
Sampling Fine Woody Debris 7.5, 7.6, 7.7 (2.1-digit; xx.y) Required.....	32
FWD Tally Rules:	33
CSE 7.5.1 1-hour (0.01 to 0.24 inch) (3-digit) Required.....	33
CSE 7.5.2 10-hour (0.25 to 0.99 inch) (3-digit) Required.....	33
CSE 7.5.3 100-hour (1.00 to 2.99 inches) (3-digit) Required.....	33
CSE 7.8 CWD Transects Piece Count (3-digit) Required	33
CSE 7.9 Log Decay Class (1-character) Required.....	33
CSE 7.10 Diameter (at point of intersection) (3,1-digit; xxx.y) Required	34
CSE 7.11 Piece Length (3,1-digit; xxx.y) Required	34
CSE 7.12 Diameter Large End (3,1 digit; xxx.y) Required.....	34
Appendix A.....	35



R1 Inventory and Monitoring Old Growth Protocols – Boulder Creek

1. Overview:

This document provides inventory protocols to be used in the Boulder Creek RNA when installing and measuring old growth monitoring plots.

1.A. General Information:

This document is intended to be used with the most recent R1 Common Stand Exam (CSE) and Inventory and Monitoring Field Guide

(http://fsweb.r1.fs.fed.us/forest/inv/cse_exams/guides.htm). All definitions and data collection methods documented in the CSE manual will be used unless specifically stated within this document. Only those items listed in this document will be recorded.

Note for Remeasurement: Remeasurement information will be highlighted in this color throughout this protocol. For re-measurement of these plots, follow re-measure instructions in this field guide. Update plot stakes, transect endpoints and tree monumentation as needed.

1.B Background:

Monitoring plots were installed in two treatment areas and one control area in the Boulder Creek Research Natural Area (RNA) treatment area in the summer of 2009. Plot installation was done by Bitterroot National Forest staff. In the summer/fall of 2009, Bitterroot National Forest crews installed 10 permanently monumented control plots spread across one non-treatment (control) area and 30 permanently monumented treatment plots spread across treatment areas of the same stand.

Notes from 2011 Visit:

Most plots were re-visited on 11/10/11 to look for evidence of mountain pine beetle (MPB) in both control and treatment units prior to treatment which was scheduled to begin in 11/2011. Plots 12, 16, 19, 22, 23, 24, and 25 of Treatment Unit 1, and plots 26, 27, 29, 30, 31, 32, and 39 of Treatment Unit 2 were visited. No individual plots in the control unit were visited. This field check noted that MPB was seen on the highest plots on the slope and the incidence of MPB decreased along the elevational gradient. This information was not entered into FS Veg.

Plot 32 rebar stake gone, replaced with FIA style stake (which was used to mark the end of all dwm transects during initial install – this could be confusing during re-measure).

Notes from 2012 Visit:

Post-harvest, pre-fire data was collected in treatment unit 70 in 2012 by the Timber Strike Team.

Notes from 2013 Post-treatment prescribed burning:

Slash piles were lit the day before federal employees were furloughed (October 1-16, 2013) which resulted in some low intensity fire in areas not planned for burning.

Notes from 2016 Visit:

A blowdown event occurred in the area in August, 2015. As a result, several trees were down in the plots visited. Tree diameter increases and the effects of the blowdown precipitated the need for a full remeasure of these plots in 2017.

1.C Number of Plots Installed

Ten plots were installed in the control area of unit 70 and 29 plots were installed in the treatment area.

Table 1.A. Number of plots installed and type of plot

Setting ID	Measurement #	Plot Type	# Plots
0103042501CP0001	2	Control	10
0103042501TP0001	3	Treatment	30

1.B.2 Remeasurement Information

This remeasurement will collect information on the effects of the 2013 pile burning/underburning fuels treatments that were completed in project area. In addition, this remeasurement will collect data on the effects of the blowdown event that occurred in 2015. Mountain pine beetle activity was noted in the area pre-treatment and this remeasurement will provide data on the spread and severity of the beetles in the area. As a result, it is especially important for the remeasurement crew to examine all trees and plots for these effects and to record them carefully and thoroughly.

1.C. Sample Design

A default sample design for the Tree Form (and DWM Form, if collected) have been set up in the default template file.

Table 1. Sample Design

Population of interest	Type/size of plot	Additional information
Trees		
All live and dead trees $\geq 19.0''$ DBH	1/4 th acre	58.9' radius Referred to as <i>plot</i> .
All live and dead trees 3.0'' – 18.9'' DBH	1/20 th acre	26.3' radius Referred to as <i>subplot</i> .
All live and dead trees .1'' \leq DBH < 2.9'' DBH All live and dead trees 2' – 4.4' tall	1/20 th acre	26.3' radius Referred to as <i>subplot</i> .
Vegetation Composition		
Cover by Lifeform	2 transects/50'	Tree Canopy Cover

Population of interest	Type/size of	Additional information
Cover by Lifeform	1/20 th acre	Shrub Forb Grass Canopy Cover
Cover by Lifeform by Layer	2 transects/50'	Tree
Cover by Lifeform by Layer	1/20 th acre	Shrub
Cover by species	1/20 th acre	<i>Centaurea stoebe</i> , <i>Bromus tectorum</i>
Down Woody Material		
1000-hour fuels	2 transects/50'	Down woody material 3.00"+ at intersection
100-hour	2 transects/10'	Down woody material 1.0" – 2.99" diameter at intersection
10-hour fuels	2 transects/6'	Down woody material 0.25-0.99 diameter at intersection
1-hour fuels	2 transects/6'	Down woody material 0.01-0.24 diameter at intersection
Duff and litter depth	2 Point Measurements	25' slope distance from plot center

Remeasurement Overview:

- Identify and remeasure trees and saplings from prior measurement.
- Add trees that were missed and trees and saplings that have grown into the plot since the prior measurement.
- Collect GST information on trees that have grown into the plot, trees that were previously recorded as dead and trees that were missed during the last measurement.
- Recollect all seedling data in its entirety. No prior measurement data will be provided in the electronic data file.
- Recollect all vegetation composition data in its entirety. No prior measurement data will be provided in the electronic data file.
- Recollect all down woody material data in its entirety. No prior measurement data will be provided in the electronic data file.

[illegible]

Two down-woody transects will be laid out from plot center in the same orientation as the canopy cover transect, even number plots orient north and east, odd number plots, orient south and west.

At 25', measure duff and litter depth

Along 25' – 35', pieces 1.0-2.9"

Along 25' – 31', pieces 0.1- 0.9"

Plot center, 0'

Along entire 50' transect, pieces ≥ 3.0 " diameter and larger that are at least 3.0' long

1.D. Order of Measurement

A. Enter basic Setting Form information

1. Locate and monument plot as needed.
2. Locate Tree Canopy Cover Transects. Collect Tree Canopy Cover.
3. Collect DWM and FWM, Duff and Litter measurements.
4. Locate micro-plot. Collect information on supplemental form, Appendix D
5. Collect vegetation composition of Grass, Forb, Shrub.
6. Collect Plot data (GPS has been acquiring plot locations while on plot)
7. Collect Large-tree data.
8. Fill out Setting Form attributes that are dependent upon plot measurements: aspect, slope, habitat type
- 9.

2. Plot Monumentation

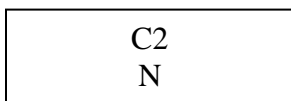
2.A. Plots

Monument plots with a piece of rebar. Affix an aluminum tag with 'C' or 'T', indicating Control or Treatment, and plot number inscribed on the tag. For example: C2 indicates Control, plot 2. Tie a piece of flagging around the rebar and hang a piece of flagging from the branch of a tree that is at least 5 feet off the ground but near to plot center.

Remeasurement: NOTE: Do not change plot numbers. Replace missing rebar plot monumentation stakes with bent aluminum stakes with aluminum tags as needed.

2.B. DWM Transects

Monument down woody material transects with an aluminum tag affixed to a stake with 'C' or 'T', indicating Control or Treatment, plot number, and the cardinal direction of the transect from plot center. Example:



Remeasurement: Replace missing DWM transect ending stakes with bent aluminum stakes with marked tags affixed as indicated above.

2. C. Trees

Trees will be numbered starting with one and continuing consecutively starting from north. Trees on the ¼ acre plot were numbered prior to tallying trees on the 20th acre plot during installation for Treatment Plots 38 and 39. Hang tags where DBH is measured on the uphill side.

- All trees ≥ 10.0 " DBH were tagged at time of installation with the tag number that is assigned in Exams software. Azimuth and distance were recorded for trees ≥ 3 " DBH.

Note: If no trees $\geq 10.0''$ DBH exist on the plot, tag at least two tally trees $\geq 3.0''$ DBH and record the distance and azimuth on the Tree Form in the Tree Remarks field. It is best to select trees that are at least 90° different from each other.

Inscribe each tree tag with 'C' or 'T', indicating Control or Treatment, and plot number. Underneath write “#” with the tree number following. If azimuth and distance has been recorded for an off-plot tree, instead of putting a tree number, scribe “witness.” An example tree tag is:

C2 #7

Indicates Control, plot 2, tree number 7.

Remeasurement:

- Replace tree tags and nails as needed. Tag all trees $\geq 3.0''$ DBH.
- Monument ingrowth and missed trees as per specifications above.

4. Plot Establishment:

Plots were established in treatment and control areas. Coordinates will be supplied for each plot location in latitude and longitude, NAD 1983. Each GPS must be set accordingly. Navigate to each plot by stopping approximately 50 feet short of the plot, using the navigation function, and pacing to the plot center.

Remeasurement:

GPS coordinates will be provided for all plots.

5. Setting Data

All data collected is as indicated in the value column. If value is not indicated, then follow R1 CSE field guide definitions for the attribute.

Table 3. Setting Data Form

CSE Attribute #	Attribute Name	Value	Comments	Re-measure
2.1	Project Name	BC OG Monitoring	Default	Update to: BC OG Monitoring MFR2
2.2	Proclaimed Region	01 Region One	Default	Do not change
2.3	Proclaimed National Forest	03	Default	Do not change

CSE Attribute #	Attribute Name	Value	Comments	Re-measure
2.4	District	04 WestFork	Default	Do not change
2.5	Location	2501CP control 2501TP treatment	Depends on if in control or treatment units. Choose from drop-down list.	Do not change
2.6	Stand Number	0001	Default	Do not change
2.7	Owner	USFS	Default	Do not change
2.8	State	MT	Default	Do not change
2.9	County	81 Ravalli	Default	Do not change
2.10	Admin Forest	03	Default	Do not change
2.11	Date		Enter the date in MMDDYYYY format	Update with current date
2.13	Exam Level	3220		Change to: 3 – Intensive Tree 2 – Lifeform Layer (Tree/Shrub) 2 – Brown’s Protocol
2.14	Exam Purpose	IM	Inventory and Monitoring plots	Do not change
2.18	Potential Veg Ref	101	Forest Habitat Types of Montana	Do not change
2.19	Potential Veg			Do not change
2.23	Setting Elevation			Do not change
2.24	Setting Aspect			Do not change
2.25	Setting Slope			Do not change
2.28	Examiner		Put in first and last initials of each crew member.	Update with current examiners
2.29	Precision Protocol	CSE	Default	Do not change
2.30	Radial Growth Interval	10	Default	Do not change
2.34	Setting User Code	CNTL TRMT	Control Treatment	This formerly had Datum. Update with type of plots in the stand.
2.35	Setting Lat Long Reference Datum	NAD 83		Update
2.36	Magnetic Declination	19°		Update
2.37	Measurement #	2 or 3	2 for control plots/ 3 for	Do not change

CSE Attribute #	Attribute Name	Value	Comments	Re-measure
			treatment plots	
2.38	Setting Remarks			Update as necessary- Delete prior remarks that are no longer applicable.
2.39	Setting Damage Category		Damages that are observed while walking through the setting that are not observed on the plots.	Update with new damages observed in the stand that are not recorded on the plots and delete any damages that are no longer applicable.
2.40	Setting Damage Agent		Used with setting level damages	Update as necessary. See 2.39.
2.41	Setting Damage Severity		Used with setting level damages	Update as necessary. See 2.39.

4. Plot Data Form

Coordinates will be supplied for each plot center in latitude and longitude, NAD 1983. Each GPS must be set accordingly.

It is the responsibility of the field crew to relocate the plot location center (PC) on the ground according to the stated plot coordinates.

Use the following global positioning system (GPS) procedures as the primary method for locating the PC. Refer to R1 CSE Supplemental Appendix C for general GPS operating instructions and settings. Note that there are many makes and models of GPS that can work for plot establishment; the next section discusses GPS requirements.

1. All GPS data must use the following format for latitude/longitude coordinates:

- Datum – NAD 1983
- Geographic System – Latitude/Longitude (Lat/Long)
- Format – ddd'mm'ss.s

2. Acquiring GPS Coordinates for the PC. Use the GPS to find the position (coordinates) of the PC (see section 4.2). Record PC geographic coordinate information on the Exams Plot Form, item 4.2.1 and 4.2.2.

- ❖ **Tolerance (Finding the PC):** Estimated Horizontal Error (acquiring PC coordinates):
 ± 10 meters

Table 4. Plot Data

CSE Attribute #	Attribute name	Comments	Remeasure
4.1	Plot Number	Use the plot number assigned in Arc Pad.	Do not change.
4.2.1	Plot Latitude	See instructions below	Do not update latitude unless value is > 500' off (approx. 5 seconds). If latitude needs to be updated, note in Plot Remarks field.
4.2.2	Plot Longitude	See instructions below	Do not update longitude unless value is > 500' off (approx. 5 seconds). If longitude needs to be updated, note in Plot Remarks field.
4.4	Aspect		Field populated from prior measurement. Do not change unless obvious error. Tolerance ± 10 degrees. (Declination is set to 19 degrees)
4.5	Slope		Field populated from prior measurement. Do not change unless obvious error.
4.11	Plot Potential Veg.	Record the predominant habitat type found on the ¼ acre plot.	Should be populated in Exams software data file. If this value is outside of tolerance, update and put explicit information in the Plot History Remarks form. Remember, this is pre-fire habitat type, which will probably represent the true potential vegetation if the fire

CSE Attribute #	Attribute name	Comments	Remeasure
			has greatly disturbed the site.
4.15	User Code	Average litter depth calculated from the two litter measurements was entered into this field. <i>This field is no longer used for this purpose.</i>	No longer used for litter depth. If underburning is evident on plot record BURN.
4.16	Plot History	Enter code for activities or disturbances seen on 1/4 th acre plot.	Update if needed. Delete codes that are no longer applicable.
4.18	Plot Remarks		<ul style="list-style-type: none"> • Enter highest flame length • Enter crown fire evidence • Note Mountain Pine Beetle activity • Note fire • Note blowdown • Enter number of slash piles on the 1/4 acre plot • Note monumentation stake replacement • Note retired tree numbers
	Witness Tree/Navigation		Not used.

CSE 4.15 Plot User Code

This field may contain an average litter value calculated during the last measurement.

Remeasurement: Delete average litter value. If fire is evident on plot, enter BURN. If tree was down prior to the 2016 blowdown event, do not enter code.

CSE 4.18 Plot History/Remarks (Required)

This field is used to enter information about the plot that is not captured elsewhere. Separate the following information types with a space between each entry.

Remeasurement:**A. Flame length information**

Record the highest flame length, based on the height of scorch seen on trees, observed within the plot. Estimate the height of the highest scorch mark measured on the uphill side of the tree. Record FLXX, where XX is the height (feet) rounded to the nearest foot.

B. Crown fire evidence

A crown fire is a fire that spreads from tree crown to tree crown. If there is evidence that a crown fire occurred on the plot, then record CRY. If there is no evidence a crown fire occurred, then record CRN.

C. Enter the number of slash piles seen on plot in this format: “piles:XX”, where XX is the number of piles. Piles must be at least half inside the plot radius to count. Also, if the fine fuels are not re-measured due to slash piles, record: “FFX Not Measured” where X is the cardinal direction of the transect where the fine fuels are not measured – if both transect have piles on the fine fuels transect, record FFXX Not Measured, where XX is both cardinal directions, ex NE.

D. Enter “MPB” if mountain pine beetle activity has been seen on the plot.

E. Enter “BLDN” if tree blowdown has occurred on the plot since the pile/underburning activities have taken place. Do not enter the blowdown code in this field if trees on the plot were down (knocked over by harvest treatments) prior to the underburning in 2013, as evidenced by scorched bark all along the length of the tree indicating it was down before the burn.

F. If the plot stake was not relocated by the crew and a replacement was installed, make a note here.

G. Record notes about the plot that are not captured in other fields, such as retired tally tree numbers.

5. Tree Data Form:**Remeasurement:**

Follow instructions under Remeasurement column in Table 5.2 below.

Follow procedures indicated in Section 5 of the R1 CSE/IM Field Guide for the Tree Data Form unless indicated otherwise below. Field number, name, and size (digit/character width) are as indicated in the field guide. Enter all tree data into Exams software Tree Data Form.

Table 5. Trees to inventory

Tree diameter or height class	Plot size (acre)	Trees to inventory	Remarks
2.0 – 4.4' tall or .1" – 2.9" DBH	1/20	Live and Dead	For trees ≤ 3.0 " DBH, record each GST tree (attribute 5.5) individually, Group all other trees < 3.0 " by height classes
3.0 - 18.9" DBH	1/20	Live and Dead	Record each tree individually. Tag trees that are 3.0"+ dbh
19.0" + DBH	1/4	Live and Dead	Tag and record each tree individually

Table 6. Tree Data

Attribute #	Attribute Name	Comments	Re-measure
5.1	Plot #		Do not change
5.2	Tag ID	Only trees ≥ 10.0 " DBH were tagged in the prior measurements. Additional trees will be tagged during this remeasurement. Hang tag at the height and location that DBH was measured.	Do not change existing tree numbers. Tag all trees ≥ 3.0" DBH. Only trees > 10.0 " DBH have been tagged to date. If trees are gone, delete them, if new trees are added, use the next available tree number – <u>never re-use old numbers or renumber trees.</u> In treatment units this is the third measurement, so many tree numbers have already been retired. Seedling groups from the prior measurement have been deleted in the data file. Completely remeasure and renumber seedlings after trees and saplings ≥ 3.0" DBH have been numbered.
5.3	Tree Status		Update
5.4	Tree Class		Update
5.5	Growth Sample	All trees ≥ 19 " DBH were marked as GST Trees.	Only collect GST information on trees that were missed during installation, trees that were formerly called dead but are now alive, and ingrowth trees, saps, and seeds.
5.6	Tree Species		Do not change unless error. If changed, enter tree note.

Attribute #	Attribute Name	Comments	Re-measure
5.7	Tree Count	For trees <3.0" dbh, once GST trees are selected, group remaining trees by species and height class according to CSE 5.7 instructions.	Entirely re-do counts for seedlings.
5.9	DBH	Place nail with tag at the exact location where DBH is measured so the measurement can be duplicated. For trees <3.0" dbh, once GST trees are selected, group remaining trees by species and height class, record average diameter for group.	Remeasure DBH. Do not change nail location unless the nail is more than 12" from 4.5'. Measure for missed and ingrowth trees and saplings.
5.10	Height	Measure height on <i>all</i> trees. For grouped trees, record average height for group.	Update
5.11	Height to Crown	Record on all trees to the nearest foot	Update
5.12	Radial Growth	Record Radial Growth for all GST trees ≥ 3.0 " DBH.	Value will be blank unless the radial growth was measured during the prior inventory, then the radial will be included. Do not remeasure. Only measure radial growth on missed and ingrowth trees, saplings, and seedling and on trees that were formerly called dead, but are now alive.
5.14	Height Growth	Follow GST rules for trees with DBH < 3.0".	Only measure radial growth on missed and ingrowth saplings and seedling. Do not bore trees that have been bored before.
5.15	Tree Age	Record for all GST trees. If tree has rot, the borer is not long enough, or the core falls apart, enter the age to the break/rot/end of borer in the remarks field after AE1, enter the estimated age in the age	Value will be blank unless the age was measured during the prior inventory, then the age will be included. Do not remeasure. Only measure age on missed and ingrowth trees, saplings, and seedling and on trees that were formerly called dead, but are now

Attribute #	Attribute Name	Comments	Re-measure
		field.	alive. Do not bore trees that have been bored before.
5.16	Crown Ratio	Record for all trees. Record average for grouped trees < 3.0” DBH.	Update
5.17	Crown Class	Record for all trees. Record average for grouped trees < 3.0” DBH.	Update
5.20	Snag Decay Class		Update
5.22	Damage Category	Record for all trees 4.5’ and taller.	Always record the following codes when present: 30 – Fire 11 – Beetle 50 – Abiotic Damage *See 5.23 for agents
5.23	Damage Agent	Record for all trees 4.5’ and taller.	Record for all trees \geq 3.0” DBH. Value from previous measurement will be included. Re-evaluate. If a damage that had been previously recorded is no longer detectable, delete. Record any new damages now present and not recorded at last measurement for live trees and trees that have died since last measurement. Always record the following codes when present: 30 – Fire <ul style="list-style-type: none"> • 033 – Crown Fire Damage • 034 – Ground Fire Damage 11 – Beetle <ul style="list-style-type: none"> • 007 – Doug Fir Beetle • 006 – Mtn. Pine Beetle 50 – Abiotic Damage <ul style="list-style-type: none"> • 013 – Wind/Tornado 99 - Physical Effect <ul style="list-style-type: none"> • 019 - Scorched Foliage • 020 - Scorched Bark

Attribute #	Attribute Name	Comments	Re-measure
5.24	Damage Part	Was recorded for all trees 4.5' and taller.	Record for all trees ≥ 3.0" DBH. Value from previous measurement will be included. Re-evaluate. If a damage that had been previously recorded is no longer detectable, delete. Record any new damages now present and not recorded at last measurement for live trees and trees that have died since last measurement.
5.25	Damage Severity	Was recorded for all trees 4.5' and taller.	Value from previous measurement will be included. Re-evaluate. If a damage that had been previously recorded is no longer detectable, delete. Record any new damages now present and not recorded at last measurement for live trees and trees that have died since last measurement. For recent mortality trees, code highest severity.
5.26	Remarks	Distance and Azimuth were entered in this field.	Delete azimuth and distance information in this field. If a tree was obviously missed during the initial inventory and is tallied during the re-measure, make a note of "Missed Tree" in the tree remarks field.
5.29	Tree Distance	Enter for trees ≥ 3.0 " DBH	Correct if out of tolerance. Add for new trees and missed trees.
5.30	Tree Azimuth	Enter for trees ≥ 3.0 " DBH	Correct if out of tolerance. Add for new trees and missed trees.

CSE 5.1 Plot Number (3-digit) *Default*

CSE 5.2 Tag ID Number (4-digit) *Default*

Tally qualifying trees that fall within the **horizontal distance** of the sample plot perimeter.

Work clockwise from 1 to 360 degrees azimuth, and outwards from the PC stake to the sample plot perimeter. Refer to R1 CSE/IM Field Guide, Appendix H, for the list of tally tree species.

Tally Tree Procedures and definitions:

1) Plot and Subplot Tally: At PC, starting at 1 degree azimuth, rotate clockwise and individually tally all qualifying trees with a diameter ≥ 19.0 inches that fall within the perimeter of the plot (58.9-ft horizontal distance). Also individually tally all live and dead trees that have a DBH within the following range: $3.0 \text{ inches} \leq \text{DBH} < 18.9 \text{ inches}$ and tag all new trees and trees < 10.0 inches DBH that fall within the perimeter of the sub-plot (26.3-ft radius horizontal distance). Tag all trees ≥ 3.0 " DBH.

In addition, tally seedlings (2.0-4.4 ft. tall) and saplings (0.1-2.9 inches DBH) that fall within the perimeter of the sub-plot (26.3-ft radius horizontal distance) in height class groupings. The first seedling/sapling in each height class is tallied separately as a GST tree and the rest are grouped according to the GST guidelines in section CSE 5.5 of this protocol.

Remeasure Plot and Subplot Trees:

In order to track trees over time, use the assigned Tag ID in Exams software. Retain the Tag ID for all trees formerly tallied on both the plot and the subplot. If a tree has grown from the subplot to the plot (diameter is now ≥ 19 " DBH) retain the previous measurements Tag ID. Any missed/ingrowth trees will be assigned the next Tag ID available regardless of where they are located on the plot. For example, if the last tree tallied on the last measurement was 11, the next available tree number is 12. **NEVER** renumber the trees on the plot after installation in order to assign a more "correct" tree number to a missed tree.

Numbers assigned to trees that have been removed from the plot (i.e. due to harvest), that are no longer standing due to mortality, or were mistakenly recorded will be deleted and not reused. Their numbers will be noted in the Plot Remarks field.

Assign new GST designations for ingrowth trees and saplings and collect appropriate data. Collect GST information on trees that were previously recorded as dead that are now alive. Assign new Tag ID Numbers to all saplings, live or dead, added since previous measurement, and collect appropriate data.

Disregard Tag IDs assigned to prior seedling counts, as they will be fully remeasured after sapling remeasurement, and utilize next available Tag ID after Subplot trees/Sapling trees from prior measurement if assigning new tally trees. Collect and record seedling counts last. Assign the next highest Tag IDs to the seedling groups after all other tally trees have been recorded.

Make note of any tree tag numbers that are removed due to due to harvest, falling down, etc in the Plot Remarks Field (Item 4.18).

CSE 5.3 Tree Status (1-character) *Required*

Record a TREE STATUS code to identify each sample tree as live or dead.

Remeasure Tree Status:

Update, if needed. If a tree goes from live to dead between measurement cycles, in

addition to updating the tree status, enter a cause of death in the damage category and agent fields if damages can be reasonably determined.

CSE 5.5 Growth Sample Tree (1-character) Required for GST trees

Record this item only for Growth Sample Trees (GST). Leave blank for all other trees. GST are defined as all trees meeting the “GST Selection Guidelines” below. GST is indicated with a G.

GST Tree Selection Guidelines:

- 1. Growth Sample Trees (GST).** On each plot (moving clockwise from azimuth 001 to 360 degrees), designate the first live, standing sample tree *of each species* in each of the following size classes as a GST:

Plot Type	GST Class - Height or DBH range	
Subplot	< 3.0” DBH ^(a)	2 – 4 feet tall
		5-12 feet tall
		> 13 feet tall
	3.0 – 4.9 inches DBH	
	5.0 – 8.9 inches DBH	
	9.0 – 14.9 inches DBH	
	First tree ≥ 15.0 inches DBH ^(b)	
Plot	All trees ≥ 19.0 inches DBH ^(b)	

- ^(a) **Trees < 3.0-inches DBH** – to qualify as a GST, trees < 3.0-inches DBH must have a live, intact terminal leader (the most recent complete height increment); if the first tree < 3.0-inches DBH does not meet this criteria, designate the next qualifying tree on the plot < 3.0-inches DBH as the GST.

Remeasure GST Trees:

Collect GST information on any ingrowth trees/saplings, missed trees/saplings, and trees that were previously recorded as dead that are now alive.

CSE 5.7 Tree Count (3-digit) Required for seedling groups; defaulted for tally trees

Record the number of trees represented by each line of tree data.

Subplot Seedlings (trees < 4.5 feet tall): Once a GST tree has been selected for each species group, the remaining seedlings of that species, are counted and grouped by height classes on each subplot.

Subplot Saplings (trees < 3.0” DBH) All non-GST trees less than 3.0” DBH are grouped by species and height classes and recorded using Subplot GST and Species Groups Form, Appendix C. Record the totals, using a single data line for each seedling group, and record the number of trees within the group for TREE COUNT.

Remeasure Seedling Counts:

Complete a new seedling/sapling count during remeasurement as seedling numbers are not

included in the permanent record until they have reached at least 3.0" DBH.

❖ **Missed/Extra Tree Tolerance:**

Number of Trees on Sub-Plot	DBH	Missed/Extra Tree Tolerance
0	NA	No Errors
1+	.1 inch and larger	No Errors
Number of Trees on micro-plot	HT	Missed/Extra Tree Tolerance
1 – 5	.5 – 4.5'	± 1 tree
6+	.5 – 4.5'	± 10%

CSE 5.9 DBH (3,1-digit; xxx.y) Required for trees > 4.5' tall

Refer to Appendices L and M, R1 CSE/IM Field Guide, for instructions on measuring DBH and examples of measuring trees with bole irregularities.

Marking Diameter Measurement Position

In order for the diameter to be remeasured at the same point on the tree bole or tree stem at successive visits, the exact point of diameter measurement must be marked. Hang tags where DBH is measured on the uphill side of the tree on trees ≥ 3.0 " DBH.

Remeasure DBH:

Prior measurement is included for tally trees ≥ 1.0 " DBH. Update DBH for all tally trees live and dead. Collect DBH for any new tally trees added to plot during remeasure. Place tape directly above nail, measure diameter.

Pull nails so that at least one inch of the nail is exposed. When pulling nails, it often helps to pound them in slightly prior to pulling to break the nail free of the tree's sap. Remark aspen and woodland species with paint pen if old marks are faint or unreadable.

Remeasure DBH at the same location as the prior measurement, just above the nail. Do not move tree nails unless they are more 12 inches away from 4.5 ft. above the forest floor. If it is not physically possible to remeasure the tree in exactly the same location (e.g. tree was buried by mudslide) estimate DBH and note in Tree Remarks that DBH estimated. If an action has caused major disturbance and a tree has a new terminal leader (e.g. tree harvested below DBH and new leader has emerged) retire Tag ID# and assign new Tag ID#. Treat as a new ingrown tree.

CSE 5.10 Height (3-digit) Required for all trees, saplings and seedling groups

Remeasure Height:

Measure heights on all GST trees, trees that have broken or missing tops, and dead trees.
Determine the average height for each seedling group recorded.

CSE 5.11 Height to Crown (3-digit) Required for all trees

Record crown height (to the nearest 1.0 foot) on the uphill side of the tree, from the ground line to the base of the live crown (the lowest branch whorl with live branches in at least two quadrants, exclusive of epicormic branches and whorls not continuous with the main crown).

See Appendix Q, R1 CSE/IM Field Guide for examples of determining HEIGHT TO CROWN.

❖ **Tolerance (Height to Crown):** ± 10 percent of actual crown height

Remeasure Height to Crown:

Measure on all trees.

CSE 5.12 Radial Growth (2-digit) Required for GST trees with DBH > 3.0 inches

Refer to Appendix N, R1 CSE/IM Field Guide for guidelines on measuring radial growth.

❖ **Tolerance (Radial Growth):** $\pm 1/20^{\text{th}}$ inch

Remeasure Radial Growth:

Only collect radial growth on GST trees that have not been previously recorded. Only measure radial growth on ingrowth trees/saplings, missed trees/saplings and trees that were previously recorded as dead that are now alive. Radial growth does not need to be measured in subsequent measurements, because it can be calculated from measured diameters.

CSE 5.14 Height Growth (2,1-digit; xx.y) Required for GST trees < 3.0 inches in diameter

Refer to Appendix N, R1 CSE/IM Field Guide for additional guidelines on measuring HEIGHT GROWTH.

❖ **Tolerance (Height Growth):**

For trees with a height ≥ 6 feet: ± 1 foot

For trees with a height < 6 feet: ± 0.1 foot

Remeasure Height Growth:

Only collect height-growth for ingrowth, do not recollect height growth.

CSE 5.15 Tree Age (4-digit) Required for GST trees

Refer to Appendix O, R1 CSE/IM Field Guide for details on determining TREE AGE.

❖ **Tolerance (Tree Age)** – based on annual ring count at breast height for trees ≥ 3.0 inches in diameter; based on total age for trees < 3.0 inches in diameter:

For trees < 300 years old: ± 10 percent
For trees ≥ 300 years old: ± 15 percent

Remeasure Age:

Only collect age on GST trees that have not previously been tallied. These are new GST trees that are ingrowth, due to increased diameter or were missed in the previous measurement, or replace prior GST trees that have died or been removed. Age does not need to be measured in subsequent measurements because it can be calculated from measured ages.

CSE 5.16 Crown Ratio *(3-digit) required for live trees including seedling groups*

Refer to Appendix Q, R1 CSE/IM Field Guide for guidelines on measuring crowns.

❖ **Tolerance (Crown Ratio):** ± 10 percent

Remeasure Crown Ratio:

Collect crown ratio on all live trees.

CSE 5.17 Crown Class *(2-character) Required for all live trees including seedling groups.*

Record CROWN CLASS for all live trees.

❖ **Tolerance (Crown Class):** ± 1 class

Remeasure Crown Class:

Assess tree class for all live trees.

CSE 5.20 Snag Decay Class *(1-digit) Required for dead trees*

For standing dead trees (snags), record a SNAG DECAY CLASS code to indicate the condition of the tree. If SNAG DECAY CLASS code 1 is used indicating recent mortality (within 5 years) then record the cause of death in the Tree Damage Category field (see CSE 5.22). All other snag decay codes indicate the tree died more than 5 years ago.

Remeasure Snag Decay Class:

Evaluate Snag Decay Class for all dead tally trees.

CSE 5.22 Tree Damage Category *(2-digit) Required for trees ≥ 1.0 -inch DBH/DRC, if applicable*

For live tally trees and saplings with serious damage (see rule below), record up to three damages. For recently dead trees (those that died within the last 5 years with Snag Decay Class =1), record damage category as cause of death. For an unknown cause of death on mortality trees code category 90 “Unknown” with a severity of 9.

Code broken top on all trees including non-recent mortality (died more than five years ago with Snag Decay Class >1).

Remeasure Tree Damage:

Evaluate each tally tree for damages. If a recorded damage is no longer applicable, delete that damage. Add additional damages, if needed.

Damages of particular interest include:

- 11 – Beetle
 - 007 – Doug Fir Beetle
 - 006 – Mtn. Pine Beetle
- 30 = Fire
 - 003 = Crown Fire
 - 004 = Ground Fire
- 50 = Abiotic Damage
 - 013 = Wind-tornado
- 99 = Physical Effect
 - Scorched Bark
 - Scorched Foliage

If a tree has died since previous measurement, retain or record *only* the damage agent and category that caused the tree mortality.

If a tree was dead in the previous measurement, delete the mortality agent recorded in the previous measurement because the snag is no longer in Decay Class 1.

CSE 5.26 Tree Remarks (30-character)

Use this field to record any notes pertaining to a specific tree that may explain or describe another variable.

Additionally, use TREE REMARKS to record the following information:

5.26.1 Estimated Age Flag Required for GST trees as specified

If TREE AGE (CSE 5.15) is estimated for a GST tree, due to heartrot, record ‘AE1’ in this field.

5.26.2 DBH Height (‘DBH’ + 2 digit) Required for timber species as specified

For tally trees with bole irregularities at breast height, record the height of the diameter measurement on the tree bole. Record ‘DBHxx’ where xx indicates the height of the diameter measurement (to the nearest tenth of foot), from the ground surface to the nail, paint line, or other mark placed at DBH (refer to CSE 5.9 DBH/DRC, Marking Tally Trees).

Remeasure Tree Remarks:

Delete Tree Distance and Tree Azimuth information from this field. Record Tree Remarks as indicated above. Additionally, record information if Species was incorrectly recorded on the previous measurement.

CSE 5.29 Tree Distance (3 digit) Required for all trees all trees ($3.0'' \leq \text{DBH}$)

Remeasurement Horizontal Distance:

On the Plot, check horizontal distance, do not change the distance unless it is not within the specified tolerances. Record horizontal distance for new trees and saplings.

Note: During installation tree distances were taken to the nearest foot, not 1/10th of a foot. The distances were corrected during the 2017 remeasurement.

- ❖ Tolerance (Tree Horizontal Distance):
 - Subplot: ± 0.2 foot
 - Plot: ± 1.0 foot from 0-36.0 feet, and ± 0.1 foot for > 36.0 feet

CSE 5.30 Tree Azimuth (3-character) Required for all trees ($3.0'' \leq \text{DBH}$)

Remeasurement Tree Azimuth:

Check azimuth, do not change the azimuth unless it is outside of specified tolerances. Record azimuth for new trees and saplings.

- ❖ Tolerance (Tree Azimuth): ± 10 degrees

5. Vegetation Composition

The following information will be collected in 2017.

Complete the following Vegetation Composition and Surface Cover Forms. Sampling Methods are described in the following sections. Record Vegetation Composition exactly as it states in this section, *do not* refer to the R1 CSE Manual.

A. Cover by Lifeform and Cover by Lifeform by Layer

- **Line-intercept method on two 50' transects** for Cover by Lifeform of Trees, Cover by Lifeform by Layers for Trees
- **Ocular estimates on 1/20th-acre subplot area** for Cover by Lifeform of Shrubs, Cover by Lifeform of Forbs, Cover by Lifeform of Graminoids, Cover by Lifeform by Layer for Shrubs.

B. Cover by Species

- **Ocular estimates on 1/20th-acre subplot area** for two species, spotted knapweed (*Centaurea stoebe*) and cheatgrass (*Bromus tectorum*).

Remeasure:

For re-measurement, completely re-do the vegetation measurements explained below.

NOTE: the Cover by Species and Layer form is not used in R1.

Cover by Lifeform

For the 1/20th-acre subplot area, determine canopy cover, to the nearest percent, for the following categories (procedures specified below):

- **Total Vegetation**
- **Cover by Lifeform**
- **Cover by Lifeform by Layer**

Base all estimates on the cover of vegetation and plant parts that are (or were) alive during the current growing season, and are located within the subplot perimeter (26.3-ft radius, horizontal distance).

Table 8. Exams Cover by Lifeform Attributes:

Lifeform	Code	Attribute
	TV	Total of All Vegetation
Trees:	TOT	Total Tree Canopy Cover
	TOV	Trees Canopy Cover (layer > 6.0 feet)
	TSA	Trees Canopy Cover (layer ≤ 6.0 feet)
Shrubs:	TOS	Total Shrub
	ST	Shrubs (layer > 6.0 feet)
	SM	Shrubs (layer 1.6 – 6.0 feet)
	SL	Shrubs (layer ≤ 1.5 feet)
Forbs:	TOF	Total Forbs
Graminoids:	TOG	Total Graminoids

❖ **Tolerance (Canopy Cover):** ± 10 percent

1. **Total Vegetation (TV).** Determine the total canopy cover of all Lifeforms (trees, shrubs, forbs, and graminoids), by estimating the area of the ground surface covered by a vertical projection of the canopy of all Lifeforms combined. Only include vegetation and plant parts within the 1/20th-acre subplot perimeter (horizontal distance), that are alive (or were alive) during the current growing season. Record to the nearest 1 percent.

2. **Canopy Cover by Lifeform Protocols for TOS, TOF, TOG.** Determine the total canopy cover by Lifeform for shrubs, forbs, and graminoids. Examine each lifeform individually as if other Lifeforms do not exist. Do not double count overlapping layers within a Lifeform.

To determine, estimate the area of ground surface covered by a vertical projection of the canopy for the particular Lifeform. Only include vegetation and plant parts within the 1/20th-acre subplot perimeter (horizontal distance), that are alive (or were alive) during the current growing season. *Enter the average height within each class in the Hgt field; for TOF and TOG, enter average height in the Remarks column because the height column is unavailable.*

Record to the nearest 1 percent.

3. **Canopy Cover by Lifeform Protocols for TOT, TOV, TSA:**

Along a 100' transect, measure linear feet of tape that has tree crown above it to the nearest foot. *Every tree including seedlings and saplings should be considered. No other growth forms, only trees, should be included in the measurement. Sum up the total linear feet for a transect, this is the percent cover for the plot. Enter the average height within each class in the Hgt field.*

Transect layout:

Center the 100 foot transect on the plot center such that 50 feet extend north of plot center and 50 feet extend east for even numbered plots and south, west for odd number plots. Refer to plot layout diagram for further information.

Recording Canopy Cover

Record Tree Canopy Cover Values on the Cover by Lifeform page of the Vegetation Composition Form as follows:

Cover by Lifeform Cover by Species and Layer Cover by Species						
Life Form	Layer	Code	L/D	*Cvr%	Hgt	Remarks
	Total Veg.	TV	▶	0		
Trees		TOT	L	0		
	Hgt >= 6.1 ft	TOV	L	0		
	Hgt < 6.1 ft	TSA	L	0		
Shrubs		TOS	L	0		
	Hgt >= 6.1 ft	ST	L	0		
	1.6 ft <= Hgt <= 6.0 ft	SM	L	0		
	Hgt < 1.6 ft	SL	L	0		
Forbs		TOF	L	0		
Graminoids		TOG	L	0		

Use the transect method to derive estimates of total tree cover (TOT), cover of trees ≤ 6.0' tall (TSA), and cover of trees > 6.0' tall (TOV). Note: after TOT is measured on the transect, TSA and TOV can be estimated.

4. **Canopy Cover by Lifeform by Layer (ST, SM, SL).** Determine the total canopy cover by Lifeform for shrubs by Layer (defined below). To determine, estimate the area of ground surface covered by a vertical projection of the canopy within the predefined layer for the particular Lifeform. For each Lifeform, partition plants into layers based on those plants whose heights end in that layer (see Agave Rule below). If a Lifeform does not have members that top out within a layer, record a '0' for canopy cover for that layer. Only include vegetation and plant parts within the 1/24th-acre subplot perimeter (horizontal distance), that are alive (or were alive) during the current growing season. Record to the nearest 1 percent. *Enter the average height within each class in the height field.*

Table 9. Layers by Lifeform

Lifeform	Attribute Code	Layer
Trees:	TOV	> 6.0 feet
	TSA	≤ 6.0 feet
Shrubs:	ST	> 6.0 feet
	SM	1.6 – 6.0 feet
	SL	≤ 1.5 feet

Note: For any given Lifeform, different plants of the same Lifeform can be divided into more than one layer. However, parts of an individual plant (e.g., upper half, lower half) cannot be assigned into different layers. See “Agave Rule” below.

Agave Rule – If a plant has a seed head that grows much taller than the rest of the plant, assign the entire plant to the layer where most of the cover occurs (not the layer where the seed head tops out).

Cover by Species

For the 1/20th-acre subplot area, determine canopy cover, to the nearest percent, for the following species: spotted knapweed (*CESTM*) and cheatgrass (*BRTE*).

Note that the lifeform will always be FB (forb) and the species code will always be CESTM (knapweed) or BRTE (cheatgrass).

Veg. Composition; Setting: 01020225802580_02/10/2009 Plot: 0001

Cover by Lifeform	Cover by Species and Layer	Cover by Species	Ground Surface Cover
*LF	*Species	*Cvr%	Remarks
*	*	*	

Section 7. Down-Woody Materials Form

This section contains the following subsections: (A) Definition of Down-Woody Materials, (B) Locating and Establishing Line Transects, and (C) Down-Woody Materials Items.

7.A. Definition of Down-Woody Materials

Coarse Woody Debris (CWD)

In this inventory, CWD includes downed, dead tree and shrub boles, large limbs, and other woody pieces that are severed from their original source of growth, on the ground, and are 3.0 inches in diameter, or greater for three feet of length. CWD also includes dead trees (either self-supported by roots, severed from roots, or uprooted) that are leaning > 45 degrees from vertical.

CWD does not include:

- 1) Woody pieces less than 3.0 inches in diameter at the point of intersection with the transect.
- 2) Dead trees leaning 0 to 45 degrees from vertical.
- 3) Dead shrubs, self-supported by their roots.
- 4) Trees showing any sign of life.
- 5) Stumps that are rooted in the ground (i.e., not uprooted).
- 6) Dead foliage, bark or other non-woody pieces that are not an integral part of a bole or limb (bark attached to a portion of a piece is an integral part).
- 7) Roots or main bole below the root collar.
- 8) Pieces less than 3.0 inches in diameter for 3 feet of length
- 9) Decay class 5 pieces less than 5.0 inches in diameter for 3 feet of length and less than 5 inches from the ground.

***Note:** In this inventory, the decay stage of a piece ≥ 3.0 inches (and intersect diameter) will first determine whether the piece qualifies for tally. Refer to **LOG DECAY CLASS** (Item 7.9).

Fine Woody Debris (FWD).

In this inventory, FWD includes downed, dead branches, twigs, and small tree or shrub boles that are not attached to a living or standing dead source. FWD can be connected to a larger branch, as long as this branch is on the ground and not connected to a standing dead or live tree. Only the woody branches, twigs, and fragments that intersect the transect are counted. FWD can be connected to a down, dead tree bole or down, dead shrub. FWD can be twigs from shrubs and vines. FWD must be no higher than 6 feet above the ground to be counted.

FWD does not include:

- 1) Woody pieces greater than 3.0 inches in diameter at the point of intersection with the transect.
- 2) Dead branches connected to a live tree or shrub; or to a standing dead tree or dead shrub.
- 3) Dead foliage (i.e., pine or fir needles, or leaf petioles).
- 4) Bark fragments or other non-woody pieces that are not an integral part of a branch, twig, or small bole.
- 5) Small pieces of decomposed wood (i.e., chunks of cubical rot).

7.B. Locating and Establishing Line Transects

DWM will be measured on the same **two transects** that originate from plot center (PC stake) and extend outward **50.0 feet (slope distance)** that the canopy cover was measured on. See Table x.x for orientation of transects based on subplot number. The ends of the CWD transects are permanently marked as described in the monumentation section of this document. Mark the location of the diameter measurement on each piece of CWD with line using a timber crayon or a paint pen.

- ❖ Tolerance (Down-Woody Materials Sample):
 - Transect Azimuths: ± 10 degrees

Table 10. Azimuth of DWM transects by subplot

Subplot	CWD Transect direction	
Odd	180	270
Even	360	90

See Table 11 for information on the transect lengths used to sample Fine Woody Debris and Course Woody Material.

Fine woody debris will be measured on the transects listed below for **each** of the two 50 foot transects. Course woody debris, down-wood ≥ 3 " transect diameter, will be measured on the entire 100 feet of transect.

Litter depth and duff depth will be measured at 25' on each transect. Record the duff depths in field 7.2 and 7.3 of the Down-woody Form.

Remeasure:

Entirely remeasure the down woody material data as explained below. Down woody materials data will not be backloaded into the data recorders for remeasurement.

Table 11. Transect lengths and down-woody material diameter at intersection

Piece Diameter	Length	Total	Location
----------------	--------	-------	----------

		Length	
3.0"+, at least 3' long	50'	100'	Plot center to 100'
1.0" - 2.9"	10'	20'	25-35 ft
0.25" - .99"	6'	12'	25-31 ft
0.0" -0.24"	6'	12'	25-31 ft

Table 12. Down-woody material

Attribute #	Attribute Name	Comments
7.1	Plot number	
7.2	First Duff	Collect at point at 25' north or south. Note: record only duff depth (not litter) in this field.
7.3	Second Duff	Collect at point at 25' east or west. Note: record only duff depth (not litter) in this field.
7.x	First Litter	Collect at point at 25' north or south. Note: record only litter depth (not duff) in this field.
7.y	Second Litter	Collect at point at 25' east or west. Note: record only litter depth (not duff) in this field.
7.5	Twig1	0.01 - 0.24" at intersection (sum of both transects)
7.6	Twig2	0.25 - 0.99" at intersection (sum of both transects)
7.7	Twig3	1.0 – 2.9" at intersection (sum of both transects)
7.8	Piece Count	3.0" diameter and 3 feet long and larger
7.9	Log Decay class	3.0" diameter and 3 feet long and larger
7.10	Diameter	3.0" diameter and 3 feet long and larger
7.11	Piece Length	Required for all pieces 9.0 inch diameter and larger at point of intersection.
7.12	Diameter Large End	Required for all pieces 9.0 inch diameter and larger at point of intersection.
Plot Form:		
4.15	User Code	<ul style="list-style-type: none"> Record codes for the various impacts of interest observed on the plot. See 4.18 Plot History/Remarks below for more information. If the subplot stake was replaced, note here. Note retired tally tree numbers. If slash piles are present on plot, record the number of slash piles present on the plot as: "piles:XX" where XX is the number of piles.

***Note:** If there is no down wood or duff present on the plot, enter "0" for the two duff measurements, Exams will not allow any entries into the other fields. Following this procedure ensures that the plot was established, but that there was no down-woody material.

CSE 7.2 and 7.3 First Duff and Second Duff (2.1-digit; xx.y) *Required*

Measure FIRST DUFF and SECOND DUFF depth, as specified below. Record the duff values **in inches** to the nearest 0.1 inch (xx.x).

Duff is the layer just below litter. It consists of decomposing leaves and other organic material. The duff layer is usually dark decomposed organic matter; plant parts are not recognizable. It

does not include the freshly cast material in the litter layer. When moss is present, the top of the duff is just below the green portion of the moss.

CSE 7.2.A and 7.3.A First Litter and Second Litter (2.1-digit; xx.y) *Required*

Measure FIRST LITTER and SECOND LITTER depth, as specified below. Record the litter values **in inches** to the nearest 0.1 inch (xx.x).

Litter is the layer of freshly fallen leaves, needles, twigs (<.25 inch in diameter), cones, detached bark chunks, dead moss, dead lichens, detached small chunks of rotted wood, dead herbaceous stems, and flower parts (detached and not upright). Litter is the loose plant material found on the top surface of the forest floor. Little decomposition has begun in this layer. Litter does not include bark that is still attached to a down log, or rotten chunks of wood that are still inside a decaying log or log end (i.e. if a decayed log end has a lot of rotten cubes or pieces laying on a log surface and exposed to air, they are considered part of the log and not litter). If these rotten chunks have spilled out to the ground and are actually on the ground surface, then they would be included in the litter layer. Litter does not include animal manure.

Procedure: Carefully expose a profile of the forest floor for the measurement. A knife or hatchet helps, but is not essential. Avoid compacting or loosening the duff /litter profile where the depth is measured. Use a plastic ruler to **measure total depth of the duff and then the litter** profiles to the nearest 0.1 inch. Collect duff/litter measurements at the subplot perimeter as specified below:

- **Duff1** – Take the first duff measurement at 25.0 feet slope distance from plot center on the north or south transect, and record in the "**First Duff**" column.
- **Duff2** – Take the second duff measurement at 25.0 feet slope distance from plot center on the east or west transect and record it in the "**Second Duff**" column.
- **Litter1** – Take the first litter measurement at 25.0 feet slope distance from plot center on the north or south transect, and record in the "**First Litter**" column.
- **Litter2** - Take the second litter measurement at 25.0 feet slope distance from plot center on the east or west transect and record it in the "**Second Litter**" column.

When stumps, logs, and trees occur at the point of measurement, offset 1 foot perpendicular to the right of the sampling plane (with your back to plot center). Include portions of rotten logs in the depth measurement if the central axis of the rotten log is in the duff layer.

❖ Tolerance (First Duff; Second Duff; First Litter; Second Litter): $\pm 1/2$ inch

Sampling Fine Woody Debris 7.5, 7.6, 7.7 (2.1-digit; xx.y) *Required*

FWD is sampled along a 6-10 foot subsection of each transect and is tallied within three size classes depending on the cross-section diameter size of each piece. Collect FWD data beginning at 25.0 feet (slope distance) from the PC and extending either 6 or 10 feet (slope distance) depending on the FWD diameter-size class, as follows:

FWD Tally Rules:

Refer to Section 7 of the CSE manual. Only sample FWD that intersects a plane from the ground to a height of 6 feet.

FWD is sampled in three size classes. FWD 0.01 to 0.24 inches, and FWD 0.25 to 0.99 inch, are counted on a 6-foot transect, from 25 to 31 feet along the tape. FWD 1.00 to 2.99 inches are counted on a 10-foot transect, from 25 to 35 feet. These transects overlap.

If the fine woody materials transect falls under a slash pile, do not re-measure fine woody materials on that transect, make a plot level not of “FF Not Measured”.

CSE 7.5.1 1-hour (0.01 to 0.24 inch) (3-digit) *Required*

Record the number of small twig intersections for each transect. Small twigs are defined as pieces that have a cross section diameter of less than ¼ inch (0.01 to 0.24 inch) at the point of intersection with the sampling plane.

❖ Tolerance (Twig1): ± 40 percent

CSE 7.5.2 10-hour (0.25 to 0.99 inch) (3-digit) *Required*

Record the number of large twig intersections for each transect. Large twigs are defined as pieces that have a cross section diameter of between 0.25 and 0.99 inch inclusive at the point of intersection with the sampling plane.

❖ Tolerance (Twig2): ± 30 percent

CSE 7.5.3 100-hour (1.00 to 2.99 inches) (3-digit) *Required*

Record the number of branch intersections for each sampling plot. Branches are defined as pieces with a cross section diameter of between 1.0 and 2.99 inches inclusive at the point of intersection with the sampling plane.

❖ Tolerance (Twig3): ± 20 percent

Pile Count - count all slash piles present on the ¼ acre plot and enter that information in the plot remarks field as: “piles:XX” where XX is the number of piles.

CSE 7.8 CWD Transects Piece Count (3-digit) *Required*

Tally the CWD transect in the direction of the FWD transects first, then tally the CWD transect in the direction opposite to the FWD transect second. Tally individual CWD pieces according to the CWD tally rules stated below. Generally, CWD piece count is “1.”

❖ Tolerance (CWD Piece Count): No Errors

CSE 7.9 Log Decay Class (1-character) *Required*

In this inventory, the decay stage of a piece ≥ 3.0 inches (and intersect diameter) will first determine whether the piece qualifies for tally.

❖ Tolerance (Log Decay Class): ± 1 class

CSE 7.10 Diameter (at point of intersection) (3,1-digit; xxx.y) *Required*

For each CWD piece tallied, record the diameter at the point where the transect intersects the longitudinal center of the piece (intersect diameter). Record the intersect diameter to the nearest inch.

If the diameter is close to 3.0 inches, measure the diameter to the nearest 0.1 inch to determine if the piece is actually ≥ 3.0 inches and a valid tally piece.

- ❖ Tolerance (Diameter – at point of intersection): ± 1 inch

CSE 7.11 Piece Length (3,1-digit; xxx.y) *Required*

For each CWD piece tallied, record length to the nearest 0.1 foot. If the end of a CWD piece is buried underground, take length measurements only on the part that is above the ground (see CWD tally rules). CWD total length is the length of the piece that lies between the piece's recorded diameter at the small end (three inch minimum diameter) and diameter at the large end.

- ❖ Tolerance (Piece Length): ± 10 percent

CSE 7.12 Diameter Large End (3,1 digit; xxx.y) *Required*

For each CWD piece tallied, record the diameter of the piece's large end (large-end diameter). Record the large-end diameter to the nearest inch. The large-end diameter will occur at: (1) a broken or sawn end, (2) a fracture, or (3) the root collar. If the end of the CWD piece is splintered or decomposing (sloughing off), measure the large-end diameter at the point where it best represents the overall log volume.

- ❖ Tolerance (Diameter – Large End):
 - Pieces < 20.0 in diameter: ± 2 in
 - Pieces > 20.0 in diameter: ± 15 percent

Appendix A

Subplot Seedling/Sapling Count for Trees < 3.0" DBH											
BC OG Monitoring 2017			Proc Forest 03		District 04		Location		Stand		Plot
Species:	Tree Count	DBH <1.0"	Tree Class	Tree Status	Height	Height to Crown	Height Growth	Age	Crown Ratio	Crown Class	Damages
GST	1										
2.0'-4.4'											
Tot Tally:			(avg)	(avg)	(avg)	(avg)			(avg)	(avg)	
GST	1										
4.5'-12.0'											
Tot Tally:			(avg)	(avg)	(avg)	(avg)			(avg)	(avg)	
GST	1										
13'+											
Tot Tally:			(avg)	(avg)	(avg)	(avg)			(avg)	(avg)	
Species:	Tree Count	DBH	Tree Class	Tree Status	Height	Height to Crown	Height Growth	Age	Crown Ratio	Crown Class	Damages
GST	1										
2.0'-4.4'											
Tot Tally:			(avg)	(avg)	(avg)	(avg)			(avg)	(avg)	
GST	1										
4.5'-12'											
Tot Tally:			(avg)	(avg)	(avg)	(avg)			(avg)	(avg)	
GST	1										
13'+											
Tot Tally:			(avg)	(avg)	(avg)	(avg)			(avg)	(avg)	

Down Woody Materials Form

BC OG Monitoring 2017	Proc Forest 03	District 04	Location	Stand	Plot
--------------------------	-------------------	----------------	----------	-------	------



Measurement Direction and Distances		FWD			CWD	Litter/Duff			
		1-Hour	10-Hour	100-Hour	1000-Hour	DUFF 1	DUFF 2	LITTER1	LITTER 2
Transect Direction	Even	90° and 360°	90° and 360°	90° and 360°	90° and 360°	360°	90°	360°	90°
	Odd	180° and 270°	180° and 270°	180° and 270°	180° and 270°	180°	270°	180°	270°
Horizontal Distance		25 to 31 ft (6 ft)	25 to 31 ft (6 ft)	25 to 35 ft (12 ft)	entire transect (50 ft each)	25-ft mark	25-ft mark	25-ft mark	25-ft mark

Trans #	1-hour 0.01 - 0.24 in. XXX	10-hour 0.25 - 0.99 in. XXX	100-hour 1.00 - 2.99 in. XXX	FIRST DUFF (in.) <u>XX.X"</u>	SECOND DUFF (in.) <u>XX.X"</u>	FIRST LITTER	SECOND LITTER
1							
2							
Sum							

Coarse Woody Material (> 3.0 in)

[illegible]

Vegetation Composition: Cover by Lifeform - Tree Canopy Cover																			Total Cover (ft)	Canopy Cover (%)
Region 1	Forest		District		Plot		State		County		*Measure along two 50' transects									
Location		beg	end	beg	end	beg	end	beg	end	beg	end	beg	end	beg	end	beg	end	beg	end	
Total Tree Cover																				Add Total Cover from Transect 1 & 2
Transect 1	TOT																			
	Length																			
Transect 2	TOT																			
	Length																			
Tree Cover >6' Tall		beg	end	beg	end	beg	end	beg	end	beg	end	beg	end	beg	end	beg	end	beg	end	Add Total Cover from Transect 1 & 2
Transect 1	TOV																			
	Length																			
Transect 2	TOV																			
	Length																			
Tree Cover <6' Tall		beg	end	beg	end	beg	end	beg	end	beg	end	beg	end	beg	end	beg	end	beg	end	Add Total Cover from Transect 1 & 2
Transect 1	TSA																			
	Length																			
Transect 2	TSA																			
	Length																			